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甘肃兰州盆地中中新世泉头沟动物群的睡鼠类和沙鼠类[1)]

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摘要 记述了甘肃兰州永登泉头沟发现的一种睡鼠, *Microdyromys wuae* Qiu, 1996 和沙鼠科的二个新种, *Mellalomys gansus* sp. nov. 与 *Myocricetodon plebius* p. nov., 同时讨论了泉头沟动物群的生物年代学、动物地理学和古生态学问题。泉头沟动物群中的沙鼠类是迄今所知该科动物在我国最早的化石记录。小哺乳动物的组合表明, 泉头沟动物群与内蒙古中中新世通古尔动物群的时代和指示的生态环境大体近似, 但沙鼠类的出现, 似乎指示了泉头沟动物群代表更为干旱和开阔的自然环境。

关键词 甘肃, 兰州盆地, 中新世, 咸水河组, 睡鼠科, 仓鼠科

中图法分类号 Q915.873

为研究青藏高原小哺乳动物的进化历史和探索哺乳动物演化与青藏高原抬升的关系, 1991 年甘肃省博物馆、省文物考古研究所和中科院古脊椎动物与古人类研究所的科技人员, 在甘肃兰州永登县下街(咸水河)泉头沟龙骨湾这一经典的中中新世地点进行了化石采集。通过在咸水河组上部含化石层的取土筛洗, 获代表 7 科的小哺乳动物化石一批, 其中食虫类、跳鼠类、仓鼠类和兔形类的描述已于此前发表(邱铸鼎, 2000, 2001), 本文记述其余的睡鼠类和沙鼠类(详见本文的英文部分)。

睡鼠科的材料只有 3 枚颊齿。颊齿咀嚼面下凹, 附脊比主脊短, 冠面构造复杂, P4 的原脊和后脊近平行与内脊交接, m2 的长、宽近等而无下内脊。这些牙齿的形态与内蒙古通古尔动物群中的吴氏小林睡鼠 *Microdyromys wuae* Qiu, 1996 的特征完全一致。

沙鼠类的化石包括两个新种, 分别归入美拉尔鼠 *Mellalomys* 和米古仓鼠 *Myocricetodon* 两属。新种的特征如下:

甘肃美拉尔鼠(新种) *Mellalomys gansus* sp. nov.

特征 齿尖比齿脊醒目, 原尖和次尖的前臂比后臂粗壮。M1 前边尖为一浅沟分成双叶; 原脊和后脊很短, 因而原尖与前尖紧靠; 后边脊极弱, 后外谷不显; 齿带甚弱。上颊齿的前尖无明显的后刺, 纵脊直或微弯; m1 前边尖常有加厚的舌侧前边脊而无明显的附属尖; m1 和 m2 的下次小尖不发育; m2 和 m3 前齿根单一。

Mellalomys 在我国属首次被发现。该属现知有两种: 北非中中新统中发现的 *Mellalomys atlasi* 和巴基斯坦中中新统发现的 *M. lavocati*。新种与前者不同在于 M1 有

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一窄的后外谷,上臼齿的前尖刺(paracone-spur)不清楚,m1 的下前边尖没有舌侧附尖和明显的下次小尖,m2 和 m3 前根单一;与后者不同在于 M1 的前边尖不那么明显分开,纵脊较弯曲,M1 和 M2 的后外谷较窄,齿带很弱。*M. gansus* 的形态特征似乎与 *M. lavocati* 更接近。

普通米古仓鼠(新种) Myocricetodon plebius sp. nov.

特征 M1 前边尖单一;原尖和次尖的前臂比后臂粗壮;无后外谷,无内附尖及明显的齿带;m1 下前边尖简单,无外附尖;无纵脊,前对主尖和后对主尖为一斜谷隔开;具孤立的下次小尖。

现知 *Myocricetodon* 属有 10 余种,分布于西欧、东非和北非、西亚和南亚,在我国报道过蓝田灞河组的一未定种。新种以 M1 和 M2 无内附尖易于与 *M. seboui*、*M. ouaichi* 和 *M. eskihisarensis* 相区别;以 M1 的前边尖单一,m1 的纵脊极弱或不完整不同于 *M. sivalensis*;以无齿带和无"新"纵脊而不同于 *M. cherifiensis*;以尺寸较小,m1 的下前边尖简单,无下外附尖而区别于 *M. trerki*。*M. plebius* 在个体大小和齿尖排列上多少与 *M. parvus*、*M. irhoudi* 和 *M. ouedi* 相似,不同在于无连接前尖和次尖的"新"纵脊,以及 m1 的前边尖和前边脊较简单。新种与 *M. ternanensis* 更为相似,特别是两者的 m1 都没有明显的纵脊,后者的个体较小,并有一显著的前小脊。新种与 *M. irhoudi*、*M. ouedi* 和 *M. ternanensis* 共有 M1 前边尖简单、"正常"纵脊很退化、列型的齿尖排列方式和附尖缺失等特征,但其"正常"纵脊的退化相对比 *M. irhoudi* 和 *M. ouedi* 弱,m1 前边尖的附尖不发育,这些被认为是较 *M. irhoudi* 和 *M. ouedi* 原始的特征。

讨论 小林睡鼠属的材料不多,但代表该属在我国继江苏泗洪和内蒙古通古尔后的又一次发现。沙鼠类动物是一类适应干旱草原和荒漠地区的啮齿类动物,泉头沟发现的 *Mellalomys* 和 *Myocricetodon* 是迄今我国沙鼠科的最早化石记录。*Mellalomys gansus* 与 *Myocricetodon plebius* 牙齿的大小接近,亦有一些相似的形态特征,如齿脊弱,纵脊和齿带不发育,无中脊等。它们的区别在于前者的臼齿相对较为短宽,齿脊相对齿尖稍强,M1 前边尖分开、纵脊稍清楚、具后边脊,m1 的下次小尖不显著。

在泉头沟动物群的仓鼠中,有 3 种小型仓鼠 *Ganocricetodon cheni*、*Megacricetodon sinensis* 和 *Paracricetulus schaubi*,它们的尺寸大小与 *Mellalomys gansus* 和 *Myocricetodon plebius* 接近,形态上多少也有可比之处。但两种沙鼠上述的共同特征,又使它们不难从仓鼠类中区分出来。

迄今,泉头沟发现的小哺乳动物化石除上述仓鼠科、睡鼠科和沙鼠科外,还有猬科、林跳鼠科、跳鼠科和鼠兔科,计 11 属 12 种。这一动物群的组成与内蒙古通古尔小哺乳动物群最为接近,有 6 个相同的属,7 个相同的种(表 2)。

泉头沟动物群与通古尔动物群在组成上的相似,似乎说明了两者时代接近,所指示的生存环境近似。但泉头沟动物群沙鼠类的出现,以及仓鼠类在组成上的差异,显然又说明了其时代和指示的生境与通古尔动物群有所不同。泉头沟动物群可能反映了一个更为干旱和开阔的自然环境。

在泉头沟的 10 个已知属中,有 4 个为中亚和远东部分地区的土著分子,其余可以或在欧洲,或在北非、西亚和南亚找到,这似乎说明中中新世时这些地区的小哺乳动物有相

当密切的关系,并存在亚洲小哺乳动物通过中东通道与欧洲和非洲的相互交流与扩散。

GLIRID AND GERBILLID RODENTS FROM THE MIDDLE MIOCENE QUANTOUGOU FAUNA OF LANZHOU, GANSU

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Abstract The present paper describes one species of dormouse *Microdyromys wuae* Qiu, 1996 and two new species of gerbils *Mellalomys gansus* sp. nov. and *Myocricetodon plebius* sp. nov. collected from the upper Xianshuihe Formation at Quantougou, Gausu, followed by a discussion of the Quantougou Fauna biochronology, biogeography and paleoecology. Gerbils in this fauna represent the earliest record of the family Gerbillidae in China. Faunal correlation indicates that the Quantougou Fauna resembles the middle Miocene Tunggur Fauna of Nei Mongol (Inner Mongolia) both chronologically and ecologically. The occurrence of gerbils at Quantougou suggests that the Quantougou Fauna was adapted to a more xeric open habitat than the Tunggur Fauna.

Key words Lanzhou, Gansu, Xianshuihe Formation, Middle Miocene, Gliridae, Gerbillidae

1 Introduction

Quantougou, about 2km northeast to the village Xianshuihe (Hsienshuiho), Yongdeng County, Gansu is an important middle Miocene mammalian locality in northwestern China. Four species of small mammals and three species of larger mammals have long since been described from this locality (Young, 1927; Schaub, 1930, 1934; Pearson, 1928; Hopwood, 1935). In 1991, a team made up of the Provincial Museum of Gansu, the Institute of Cultural Relics and Archaeology of Gansu, and the IVPP conducted a screen-washing at the classic locality to determine the evolutionary history of small mammals in the Qinghai-Xizang (Tibet) Plateau and explore the relationship between the evolution of mammals and orogenesis of the plateau. Nearly 1 000 identifiable specimens of micromammals were collected from about 150kg of sediments of the upper Xianshuihe Formation, including maxillary and mandiblar fragments, representing 11 genera and seven families of small mammals. The description of the Erinaceidae, Zapodidae, Dipodidae, Cricetidae and Ochotonidae has been previously published by Qiu (2000; 2001). This paper discusses the Gliridae and Gerbillidae, and their implications towards the Quantougou Fauna biochronology, biogeography and paleoecology.

2 Systematics

Gliridae Thomas, 1897
Microdyromys **De Bruiju, 1966**
Microdyromys wuae **Qiu, 1996**
(Pl. I, 1～2)

Material Two P4 (0.70 ×0.90mm), 1m2 (1.00 ×1.10mm); V 12589.1～3.

Description The occlusal surface of the teeth is concave.

The P4 has a long and continuous protoloph and metaloph, which are parallel and join the endoloph. The anteroloph is low, short and isolated from the paracone labially, and connected with the endoloph lingually. The posteroloph is thin, but long, and joins the endoloph. The centroloph is isolated and longer than half the width of the tooth. Three roots

are present.

The m2 is wider anteriorly and double-rooted. The metalophid is strong, posteriorly curved and weak near the metaconid. The mesolophid is long and connected with the entoconid. The centrolophid exceeds half the width of the tooth in length. The anterolophid is thin and connected with the protoconid and metaconid. The posterolophid is distinct and connected with the hypoconid and entoconid. Distinct anterior and posterior extra ridges are present. Additionally, there is a weak extra ridge between the metalophid and the centrolophid.

Remarks The specimens can be assigned to *Microdyromys* on the basis of concave occlusal surface of the teeth, the complex occlusal structure with short extra ridges, parallel protoloph and metaloph joining the endoloph on the P4, length being nearly equivalent to width on the m2 and lacking endolophid. Two species of *Microdyromys* are known from the Miocene deposits of China, *M. wuae* from Tunggur, Nei Mongol and *M. orientalis* from Xiacaowan, Jiangsu. The Quantougou species is identified by size and morphology as *M. wuae*, but differs by the absence of a clear extra ridge between the mesolophid and centrolophid on the m2 (Qiu, 1996), and is distinct from *M. orientalis* in having a smaller P4 and more simple occlusal pattern (Wu, 1986).

Gerbillidae Alston, 1876

Mellalomys **Jaeger, 1977**

Mellalomys gansus **sp. nov.**

(Pl. I, 3～8)

Etymology In commemoration of the province Gansu.

Holotype A right maxillary fragment with M1; V 12595 (1.75 ×1.10mm).

Paratypes Eight maxillary fragments including 4 M1, 5 M2, 1 M3; 3 mandible fragments including 2 m1, 1 m2, 2 m3; 26 isolated teeth (2 M1, 8 M2, 3 M3, 8 m1, 3 m2, 2 m3); V 12596.1～37.

Measurements (Table 1)

Table 1 Dantal measurements of *Mellalomys gansus* (mm)

Tooth	N	Length Mean	Length Range	Width Mean	Width Range
M1	7	1.70	1.65～1.75	1.12	1.05～1.15
M2	12	1.18	1.15～1.25	1.03	0.95～1.10
M3	5	0.75	0.70～0.80	0.75	0.75～0.75
m1	10	1.46	1.30～1.65	0.96	0.95～1.05
m2	4	1.13	1.10～1.20	1.04	1.00～1.10
m3	4	0.96	0.85～1.00	0.83	0.80～0.85

Diagnosis Cusps more prominent relative to lophs, but the anterior arms of the protocone and hypocone on the upper molars rather thick. M1 with bifid anterocone divided by a shallow vertical groove, closely located principle cusps, short protoloph and metaloph, weak posteroloph and cingula, and posteroectosinus almost absent; M1 and M2 without mesoloph and a clear paracone-spur, straight or slightly curved longitudinal crest present; m1 usually with a thick lingual branch of anterolophid, but without a cusp-like lingual anterolophid; undeveloped hypoconulid on m1 or m2; m2 and m3 with single anterior root.

Description The main cusps, especially on the lower molars, are arranged in row with the lingual cusps placed anteriorly to the labial ones; the cusps are more prominent than the

lophs ; on the upper molars the anterior arms of the protocone and hypocone are stronger than their posterior ones , on the lower molars the anterior arms of the protoconid and hypoconid are weaker than their posterior ones ; a mesoloph and a mesolophid is absent on all the molars ; the upper molars are three-rooted and the lower molars are two-rooted.

M1 : The anterocone is large , with larger labial and smaller lingual lobes separated by a shallow vertical groove that disappears before reaching the base of the crown ; a weak anterior stylar shelf on the anterior face of the anterocone is present on 3 specimens. The anterolophule is lower and poorly developed , but joins the anterior arm of protocone to the lingual lobe of the anterocone. There is no distinct paracone-spur , but a swollen posterior wall of the paracone is present on some specimens. The transverse protoloph is short and joins the posterior arm of protocone. The longitudinal crest is short , straight , or slightly curved. The metaloph is short , posteriorly directed , and connected to the posterior arm of the hypocone. The posteroloph is weak and fails to reach the labial edge of the tooth. The posteroectosinus is extremely narrow. The sinus is transverse. A cusp-like or weak cingulum is present on some specimens.

M2 : The occlusal outline is subtriangular , with rounded corners and a distinct narrow posterior portion. The anteroloph is weakly developed and lucks a lingual branch on two specimens. The anteriorly-directed protoloph is short and joins the posterolabial part of the protocone. The longitudinal crest is low , short , and straight. The posteriorly-directed metaloph is connected to either the posteroloph or the hypocone. The posteroloph is weak and contacts the posterior wall of metacone. A clear postero ectosinus is absent. The sinus is transverse.

M3 : The lingual branch of the anteroloph is nearly absent ; the protoloph is directed anteriorly and joins the anteroloph ; the longitudinal crest is very short and located lingually ; and the metacone is fused with the hypocone.

m1 : The anteroconid is single-cusped and acute with the labial and lingual arms descending to the base of the protoconid and metaconid. The lingual arm may be either swollen or cusp-like. The anterolophulid is present as a low connection in two specimens , discontinuous on one and absent on the remaining specimens. A very weak metalophid is present on about half of the specimens , usually joining the anterior arm of the protoconid. The longitudinal crest is weak , low , and discontinuous on 4 out of 10 teeth. The hypolophid is indistinct , such that the entoconid is placed closer to the longitudinal crest. The posterolophid is pronounced and extends to the lingual margin of the tooth. The sinusid is wide and anteriorly-directed with a narrow labial cingulum.

m2 : A labial branch of the anterolophid is present. The metalophid is short and joins the anterolophid. The longitudinal crest is low , short , and straight. The hypolophid is indistinct and the posterolophid is strong , bearing a hypoconulid on 3 specimens. The sinusid is anteriorly-directed.

m3 : The protoconid is more prominent than the metaconid. The longitudinal crest is low and connected the protoconid with the hypoconid. The entoconid is reduced completely and melded with the hypoconid and the posterolophid to form a strong crest that joins the base of the metaconid.

Comparisons and discussion　Except for the anterior root being single on the m1 and m2 , the specimens described correspond in structure to the diagnosis of *Mellalomys* as given by Jaeger (1977a) : the third molars are not strongly reduced ; the anterocone of M1 is not strongly divided ; a longitudinal crest is normally developed ; and a cusp-like or swollen lingual branch of anterolophid is present on the m1. The genus *Mellalomys* is new for the fossil record in China.

Two species of *Mellalomys* are documented in the Miocene —*M. atlasi* from northern

Africa and *M. lavocati* from Pakistan (Lavocat, 1961; Jaeger, 1977a; Lindsay, 1988; Wessels, 1996). The new species *M. gansus* differs from *M. atlasi* in its M1 having a narrow posteroectosinus, upper molars lacking a clear paracone-spur, m1 without a lingual accessory cusp near the anteroconid and without a pronounced hypoconulid, and m2 and m3 with a single anterior root. *M. gansus* can be distinguished from *M. lavocati* by its less bifid anterocone on M1, relatively curved longitudinal crest, narrower posteroectorsinus on M1 and M2, and by its weaker cingula. In the development of cingula, paracone-spur, extra cusps, and hypoconulid, the Quantougou taxon exhibits features close to that of *M. lavocati*, but more primitive than that of *M. atlasi*.

Myocricetodon **Lavocat, 1952**

Myocricetodon plebius **sp. nov.**

(Pl. I, **9~12**)

Etymology Plebius (Latin) = ordinary, for the ordinary morphology of the new species.

Holotype A left M1; V 12597 (1.60 ×1.00mm).

Paratypes 1 M2, 1 m1, 1 m3; V 12598.1~3.

Measurements (length × width) M2: 1.20 ×1.00mm; m1: 1.50 ×0.90mm; m3: 0.80 ×0.75mm.

Diagnosis M1 with a single-cusped anterocone, relatively stronger anterior arms of protocone and hypocone, without posteroectosinus, entostyle or distinct cingulum; m1 with single-cusped anteroconid and individualized hypoconulid, without ectostylid and longitudinal crest, but an anterolingual-posterolabial valley lies between the paired cusps.

Description The cusps are prominent compared to the low and weak crests.

M1: The anterocone is single-cusped with a lingual ridge descending from the anteroloph, and a labial branch of the anteroloph is absent. The anterolophule is low, short, and connects the anterior arm of the protocone with the anterocone. The transverse, short protoloph joins the posterior arm of the protocone. The short and posteriorly directed metaloph is connected to the posterior arm of the hypocone. The short longitudinal crest is robust and nearly semicircular. A mesoloph, posteroloph, and cingulum are absent. The sinus is transverse. The tooth is three-rooted.

M2: The occlusal outline is long and narrow. The labial branch of the anteroloph is distinct, but the lingual one is absent. The anteriorly-directed protoloph joins the anterior arm of the protocone. The longitudinal crest is short and straight, connecting the posterior arm of protocone with the anterior arm of the hypocone. A mesoloph is absent. The transverse metoloph joins the hypocone. The posteroloph is undeveloped. A cingulum is absent.

m1: The main cusps are arranged in rows and the internal cusps placed closely to the external ones. The anteroconid is single-cusped, high, and sharp, with a low, narrow antero-lophid, the lingual branch of which is slightly swollen and the labial branch is connected to the base of the protoconid. The anterolophulid, metalophid, hypolophid and the arms of the main labial cusps are undeveloped. A longitudinal crest is absent and an anterolingual-posterolabial valley separates the protoconid and metaconid from the hypoconid and entoconid. The hypoconulid is prominent. The sinusid is directed obliquely anteriorly. The tooth is two-rooted.

m3: The protoconid is smaller than the metaconid. The longitudinal crest is straight, low, and joins the protoconid to the hypoconid. The entoconid is crest-like and connects the metaconid with the hypoconid.

Comparison and discussion The described teeth are characterized by the absence of a

mesoloph and mesolophid, simple anterocone on the M1, strong reduction of the longitudinal crest, arrangement of cusps in rows, and the presence of a distinct hypoconulid on the m1. These features distinguish the teeth from the small cricetids in the same fauna, as well as *Mellalomys gansus*, but correspond well with the diagnosis of *Myocricetodon*.

Myocricetodon is quite diverse, with more than 10 species recognized in western Europe, northern and eastern Africa, in addition to western and southern Asia (Lavocat, 1952, 1961; Jaeger, 1977a, b; Wessels et al., 1987; Wessels, 1996; Lindsay, 1988; Tong and Jaeger, 1993). The new species *M. plebius* can be readily distinguished from *M. seboui*, *M. ouaichi* and *M. eskihisarensis* by its lack of an entostyle on the M1 and M2; from *M. sivalensis* in its simpler M1 anterocone and absence of a longitudinal crest on the m1; and from *M. cherifiensis* in the absence of cingulum and "new" longitudinal crests. *M. trerki* is a larger species with a complicated anteroconid and a pronounced ectostylid on the m1. *M. plebius* more or less resembles *M. parvus*, *M. irhoudi* and *M. ouedi* in size and arrangement of cusps; distinctions from these taxa include the absence of a "new" longitudinal crest connecting paracone with hypocone on the M1, and the simple anteroconid and anterolophid on the m1. *M. ternanensis* is similar to the new taxon in having an anterolingual-posterolabial valley separating the anterior pair of main cusps from the posterior one, but it is smaller with a disctinct connection between anteroconid and protoconid.

Species of *Myocricetodon* appear to be greatly differentiated. *Myocricetodon plebius* seems to share characters with *M. irhoudi*, *M. ouedi* and *M. ternanensis* in the simple anterocone on the M1, very reduced "normal" longitudinal crest, arrangement of cusps, and the absence of an entostyle on the upper molars. The "normal" longitudinal crests are less reduced and the accessory cusps of the m1 anteroconid are less developed on *M. plebius* than on *M. irhoudi* and *M. ouedi*, here interpreted as being primitive features for the new species. The m1, which is the only specimen of *M. ternanensis*, is comparable to that of *M. plebius*. A minor distinction is the absence of an anterolophulid on *M. plebius*, which may imply a derived condition for the Chinese taxon.

An indeterminate species of *Myocricetodon* is reported but undescribed, from the later Miocene Bahe Formation in Shaaxi, China (Zhang et al., 1999).

3 Conclusions

Material of glirid rodents is rather scare in this collection, but represents another record of the genus *Miocrodyromys* in China since its discovery at Sihong, Jiangsu, and Tunggur, Nei Mongol (Wu, 1986; Qiu, 1996).

Extant gerbillid rodents are adapted to a xeric steppic or desert environment and widely distributed in the Mongolia-Xinjiang Plateau and Qinghai-Xizang (Tibet) Plateau in China. Fossil records of these animals are documented in deposits from the later Miocene henceforth in the Palearctic of this country. The two genera of myocricetodontines from Quantougou, *Mellalomys* and *Myocricetodon*, represent the earliest record of the family Gerbillidae in China.

In addition to the Gliridae and Gerbillidae described here, Erinaceidae, Zapodidae, Dipodidae, Cricetidae and Ochotonidae, including altogether 11 genera and 12 species, are now known from the Quantougou fauna (Table 2). The collection made in 1991 has added more material and expanded the taxa in the Quantougou Fauna. Nevertheless, unless the fauna represents a special biotope, the taxonomic list is not considered complete, because some taxa commonly known in the Neogene of North China, such as Talpidae and Soricidae among the Insectivora, and Sciuridae within the Rodentia, are still not recorded in the fauna. This is probably due to a taphonomic bias or the small amount of sediments processed from this locality.

The Quantougou fauna shows close affinities to the Tunggur Fauna, a middle Miocene local fauna in Nei Mengol. It shares six of the seven families and most of the genera with the Tunggur. Table 2 lists the occurrence of the taxa from Quantougou in Tunggur. The main differences between the two faunas are the absence of gerbillids from Tunggur and the additional presence of two species of cricetids at Quantougou. The strong similarities between the Quantougou and Tunggur faunas implies that the age of the Quantougou fauna is very close to that of the Tunggur Fauna, which was defines the Chinese Tunggurian land mammal age, considered middle Miocene or MN8 equivalent (Li et al. 1984; Qiu and Qiu, 1990).

Table 2 List of the Quantougou Micromammalian fauna and taxa occurrence in Tunggur Fauna

	Taxa in Quantougou F.	Occurrence in Tunggur F.
Erinaceidae	*Mioechinus ? gobiensis*	*
Gliridae	*Microdyromys wuae*	*
Zapodidae	*Heterosminthus orientalis*	*
Dipodidae	*Protalactaga grabaui*	*
	P. major	*
Cricetidae	*Plesiodipus leei*	*
	Megacricetodon sinensis	*
	Ganocricetodon cheni	
	Paracricetulus schaubi	
Gerbillidae	*Mellalomys gansus*	
	Myocricetodon plebius	
Ochotonidae	Ochotonidae indet.	*

Moreover, differences in the rodent composition and comparisons of taxa between the two faunas indicate a time gap and habitat distinction between the two faunas. Comparisons of *Heterosminthus* and *Megacricetodon* demonstrate that *H. orientalis* and *M. sinensis* from Quantougou are more derived than those from Tunggur (shorter mesolophs on the upper molars and on average longer ectomesolophid on the lower molars in *H. orientalis*, and more reduced mesoloph and mesolophid in *M. sinensis*). However, characters exhibited in the *Microdyromys wuae* and *Protalactaga major* of Quantougou seem to be more primitive than those of Tunggur (the former has fewer extra crests and the latter is smaller and has more bunodont cusps). Thus, the precise biochronology of the two faunas remains equivocal.

It is interpreted that the Quantougou and Tunggur faunas reflect a temperate xeric or subxeric forest-grassland mosaic, similar to the present-day Palearctic Region with the joint occurrence of Erinaceidae, Gliridae, Zapodidae, Dipodidae, Cricetidae and Ochotonidae. However, the appearance of gerbils in the Quantougou fauna and the difference in cricetid composition between the two faunas evidently indicate the two faunas distinct habitats. Small mammals in distribution differentiation in North China existed during the middle Miocene and the Quantougou Fauna reflects a generally more xeric open environment than the Tunggur Fauna.

Among the 10 genera of small mammals in the Quantougou Fauna, four (*Heterosminthus*, *Plesiodipus*, *Ganocricetodon* and *Paracricetulus*) are endemic forms confined to East and/or Central Asia, but the others occur in Europe (*Mioechinus ?*, *Microdyromys*, *Megacricetodon* and *Myocricetodon*) or Africa (*Protalactaga*, *Microdyromys*, *Megacricetodon*, *Mellalomys* and *Myocricetodon*), or West Asia (*Mioechinus ?*, *Protalactaga* and *Myocricetodon*) and South Asia (*Megacricetodon*,

Mellalomys and *Myocricetodon*). The close taxonomic relationships of the Quantougou Fauna with Europe and Africa indicate that dispersal or immigration of small mammals occurred throughout the Afro-Eurasian landmasses during the middle Miocene. However, a definitive conclusion of zoogeographic relationships and phylogenetic affinities requires further comparison and study of the species of small mammals from these regions.

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图版 I说明(Explanations of Plate I)

1～2. **似吴氏小林睡鼠** *Microdyromys wuae* Qiu, 1996

1. P4(V 12589.1); 2. m2(V 12589.3, inverse)

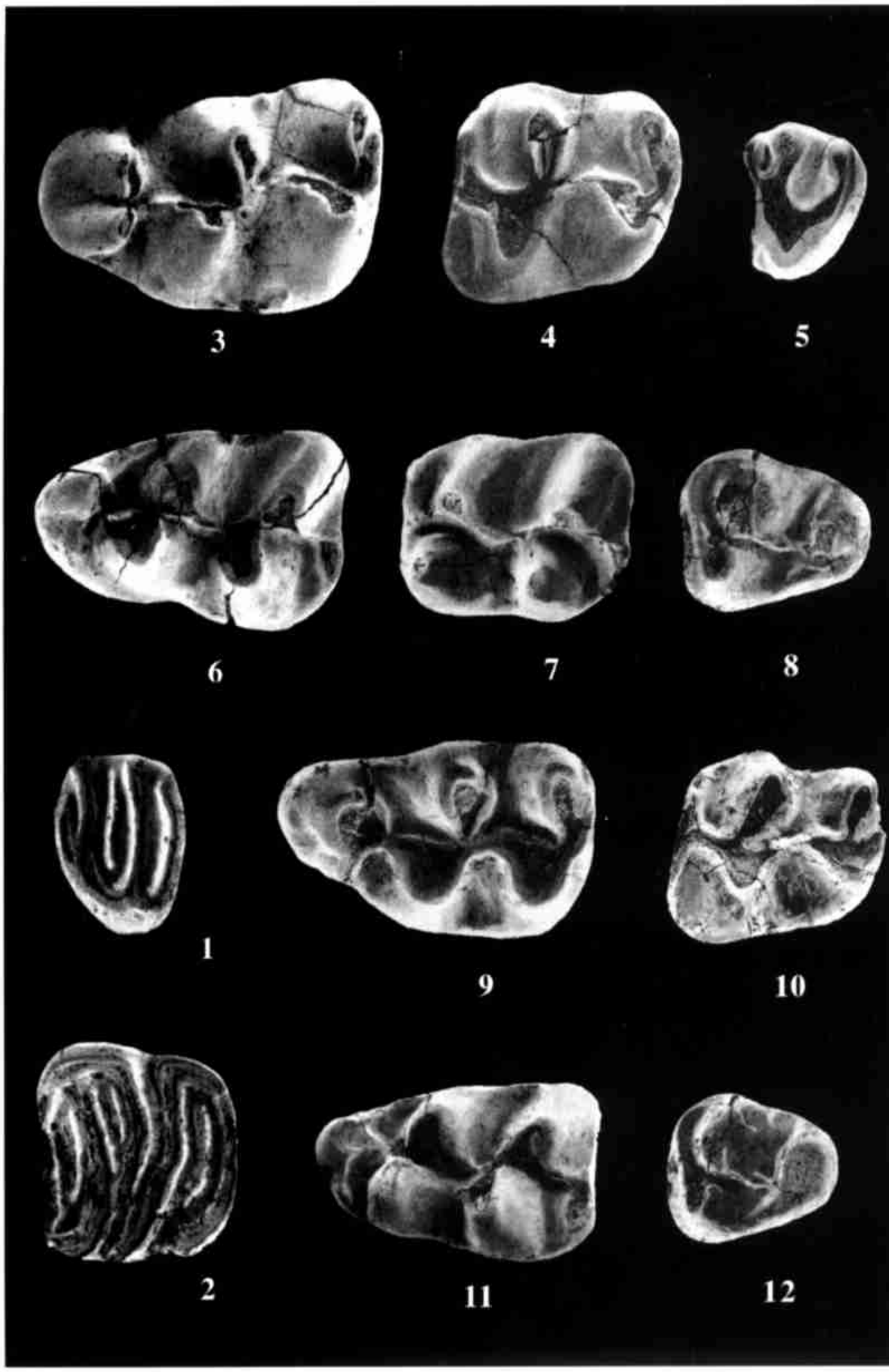
3～8. **甘肃美拉尔鼠** *Mellalomys gansus* sp. nov.

3. M1, Holotype (V 12595, inverse); 4. M2 (V 12596.14, inverse); 5. M3(V 12596.4, inverse); 6. m1(V 12596.26); 7. m2(V 12596.34); 8. m3(V 12596.11)

9～12. **普通米古仓鼠** *Myocricetodon plebius* sp. nov.

9. M1, Holotype (V 12597); 10. M2 (V 12598.1, inverse); 11. m1(V 12598.2, inverse); 12. m3(V 12598.3)

均为冠面视; **放大** 28 **倍**(All occlusal view, ×28)


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